(No Model.) 3 Sheets—Sheet 1.

C. A. WHEELER.

STEAM ENGINE.

No. 412,217. Patented Oct. 1, 1889.

Fig. 1.

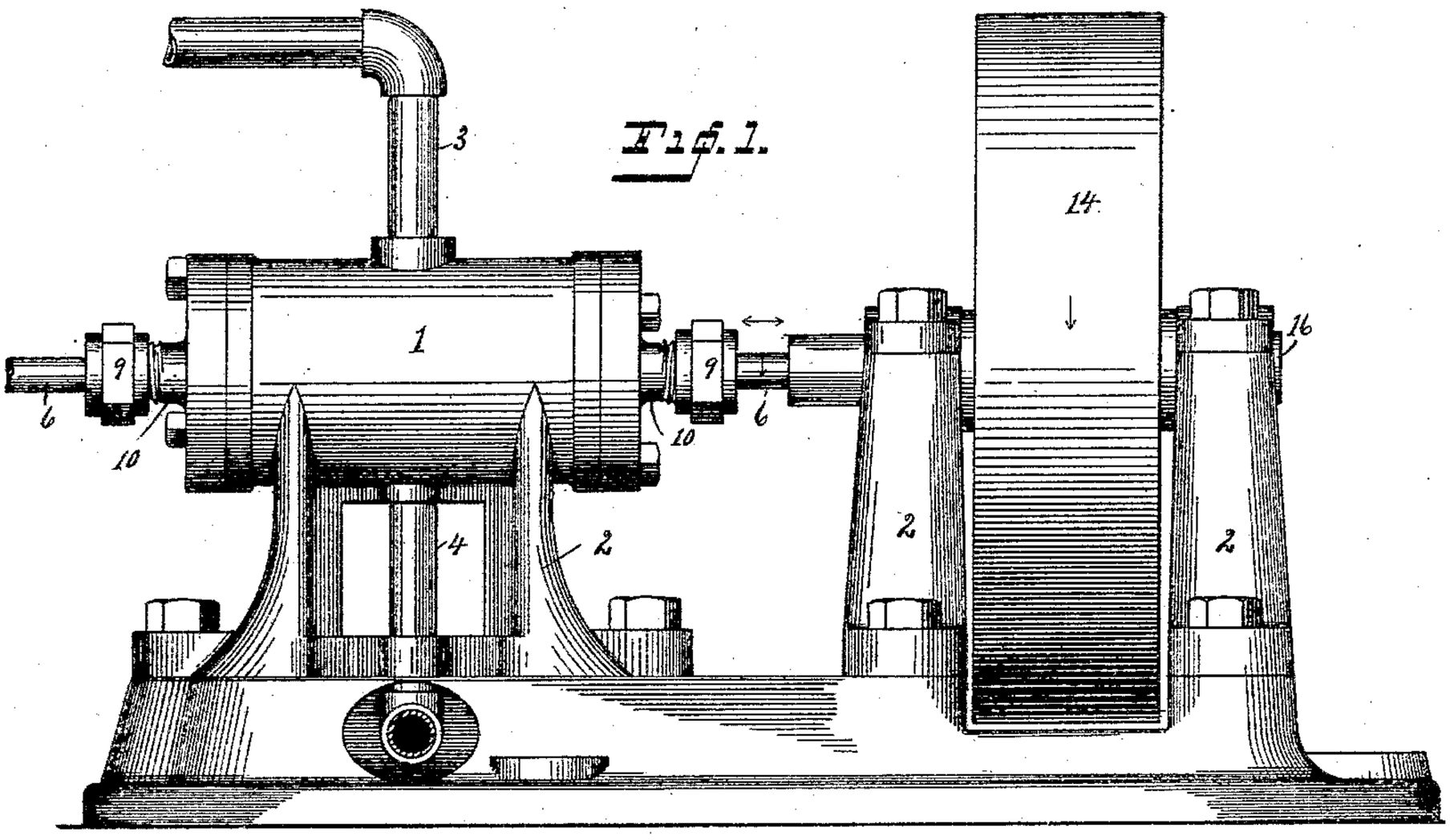
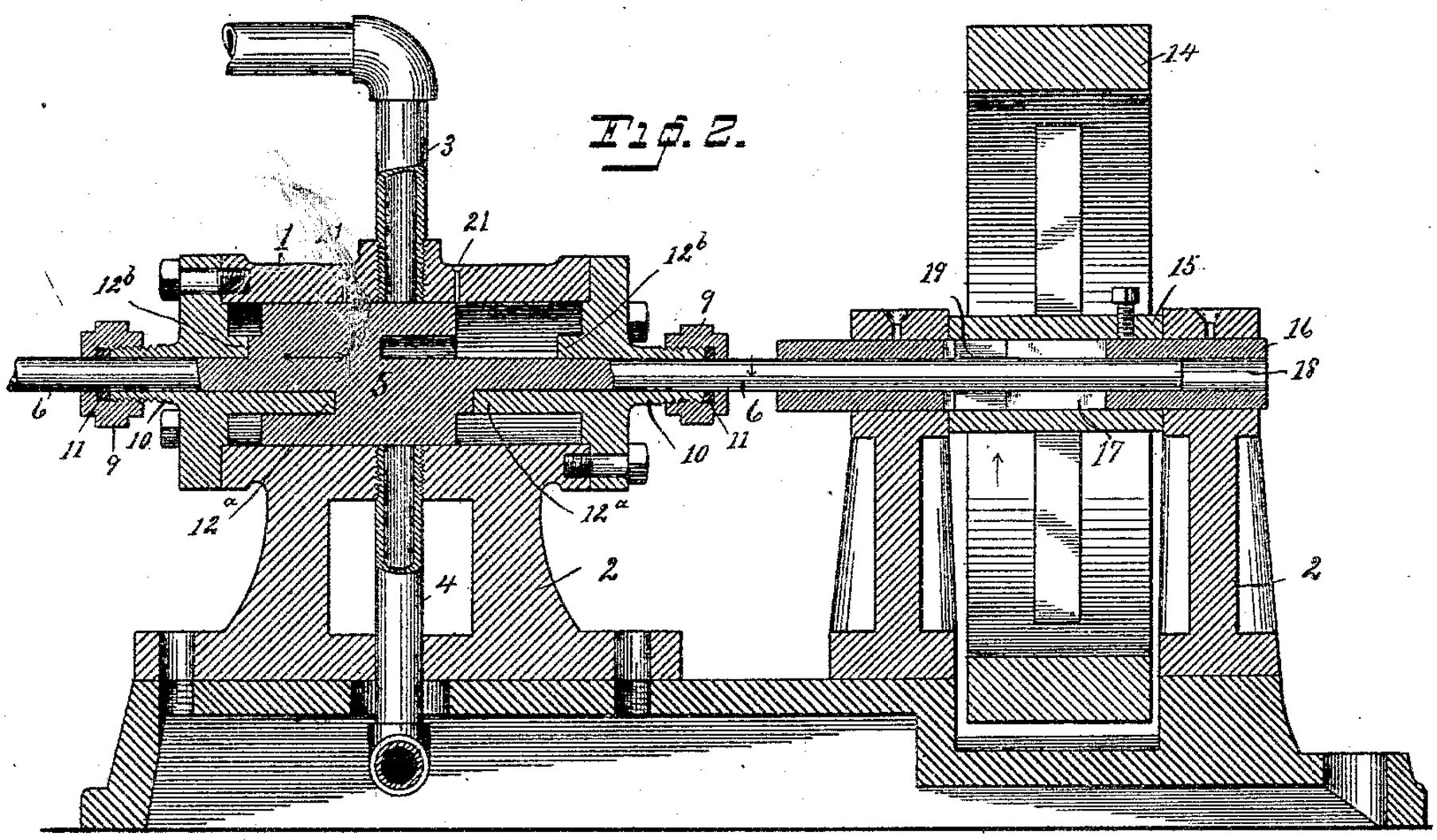


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

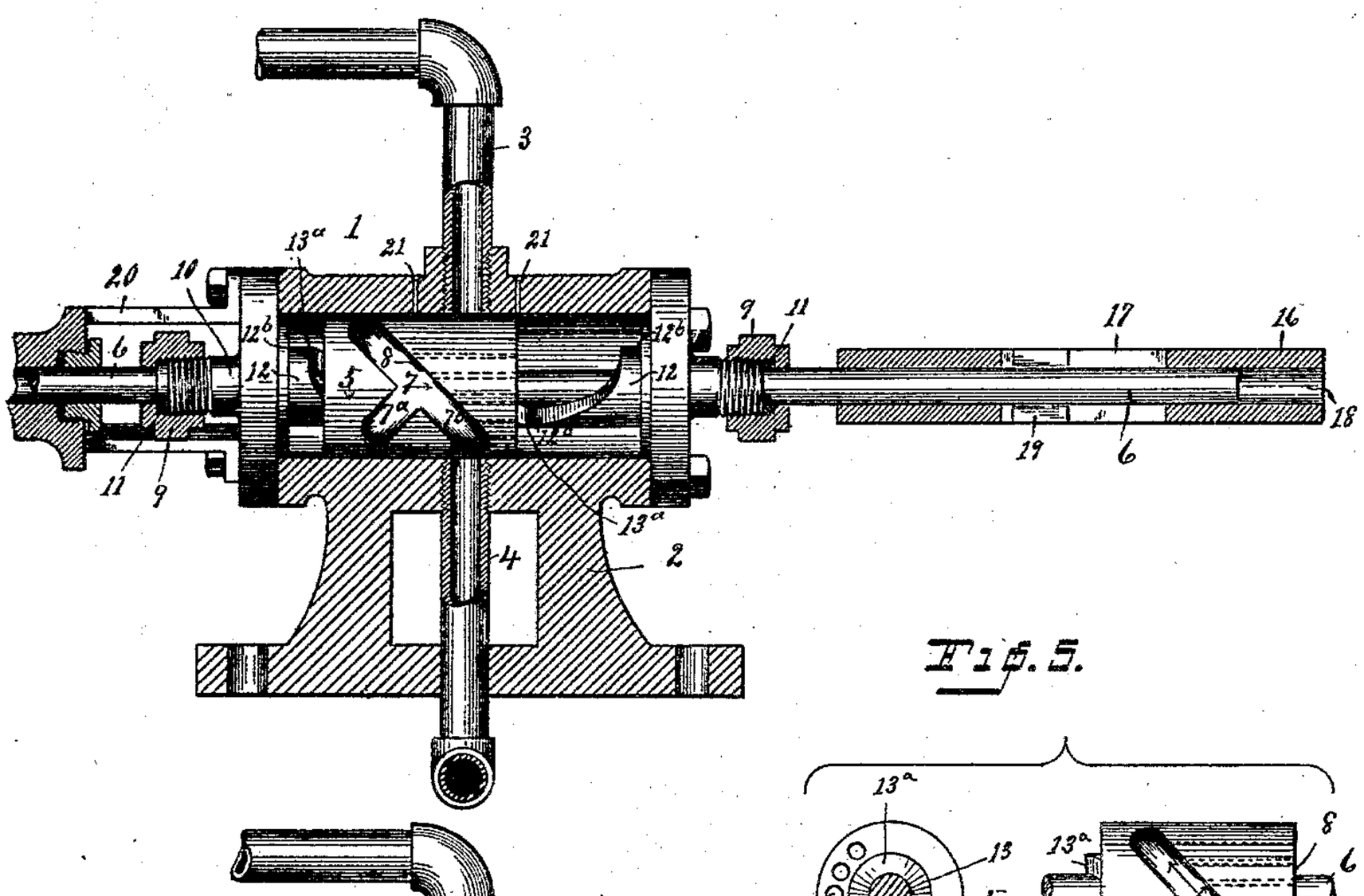

Fig. 4.

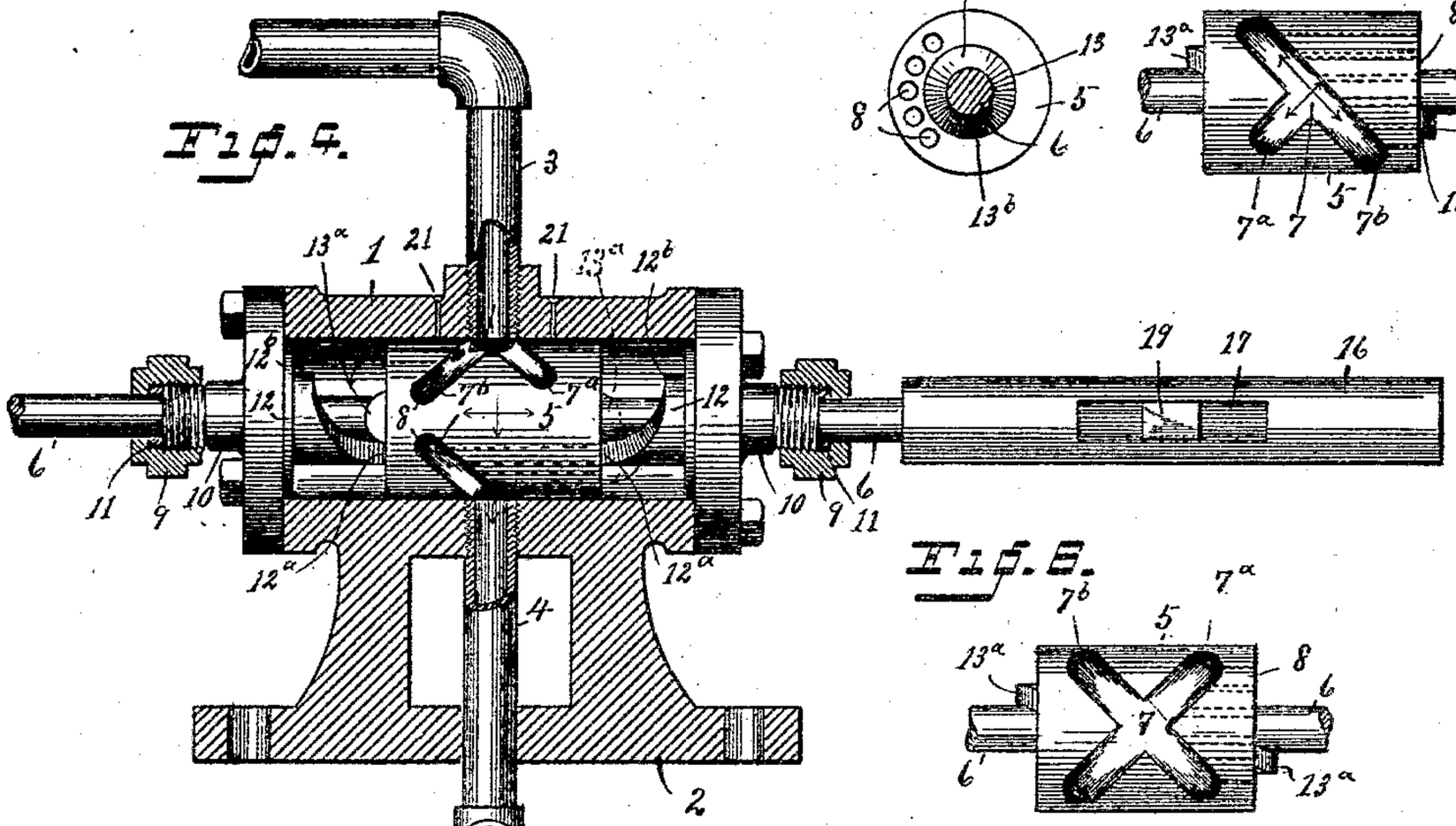

Fig. 5.

Fig. 6.

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Fig. 7.

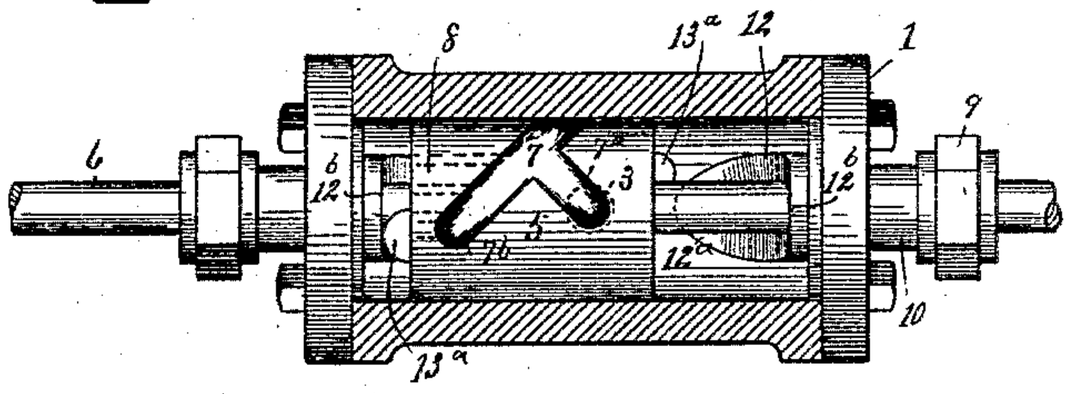


Fig. 8

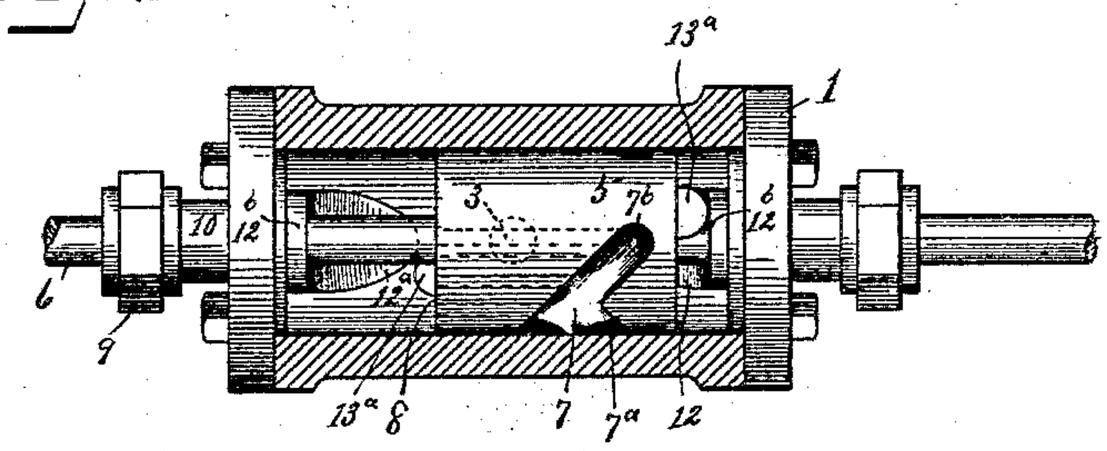


Fig. 9.

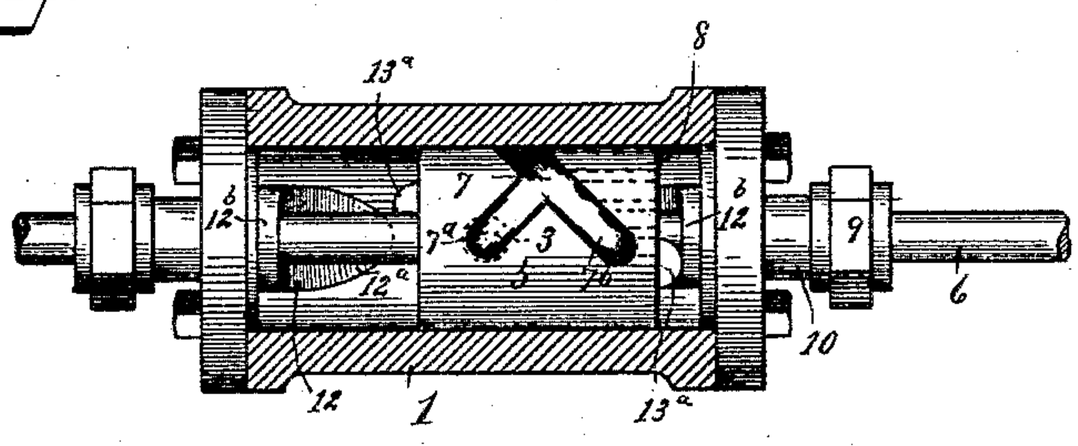
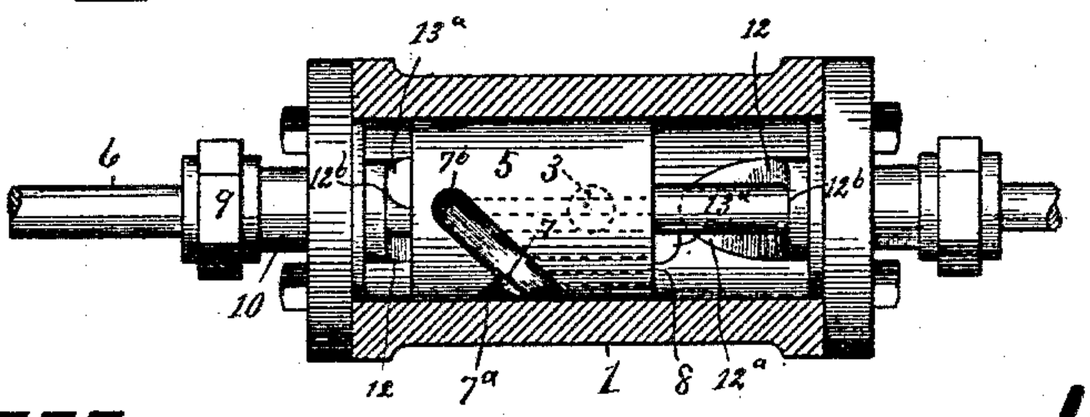


Fig. 10.



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UNITED STATES PATENT OFFICE.

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STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 412,217, dated October 1, 1889.

Application filed June 24, 1889. Serial No. 315,309. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. WHEELER, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to devise a steam-engine operating upon an entirely novel principle, in which both rotary and longitudinal reciprocating motions are produced, in which many of the parts indispensable in ordinary steam-engines shall be wholly done away with, and in which the total number of parts shall be greatly reduced and the cost of production reduced to the minimum.

With these ends in view I have devised the simple and novel construction of which the following description, in connection with the accompanying drawings, is a specification, numbers being used to denote the several parts.

Figure 1 is an elevation of my novel engine complete; Fig. 2, a longitudinal section thereof; Fig. 3, a section of the cylinder, bracket for feed-pump, &c., with the piston and cams in elevation, the balance-wheel removed, and the sleeve therefor in section, the position of the parts corresponding with Fig. 2; Fig. 4, a view similar to Fig. 3, except that the piston has made a half movement toward the right, and has made a quarter-turn, and the balance-wheel sleeve is shown in elevation. Fig. 5 illustrates the piston detached, both in end and side elevation. Fig. 6 is an elevation of a piston, showing a modified form of groove; and Figs. 7, 8, 9, and 10 are plan views of the piston, piston-rod, cylinder-heads, cams, &c., the sides of the cylinder being in horizontal section, showing, respectively, the position of the parts at the beginning of the movement of the piston toward the right, at the end of the movement toward the right, at the beginning of the movement toward the left, and at the end of the movement toward the left, the position of the steam-pipe being dotted.

1 denotes the cylinder, which is supported upon suitable frame-work 2; 3, the steam-pipe; 4, the exhaust-pipe; 5, the piston, and 6 the piston-rod, which is made integral therewith or rigidly secured thereto. The piston is provided on opposite sides with grooves 7, which I preferably make T-shaped, as shown in the drawings.

8 denotes sets of steam-passages leading from the grooves, respectively, to the opposite ends of the cylinder, one set of passages leading from the long arm of one groove to the right end of the cylinder, and the other set leading from the long arm of the other groove to the left end of the cylinder. These passages serve the double purpose of supply and exhaust passage, as will presently be fully explained. The piston-rod passes through the cylinder-heads and through caps 9, which are right and left threaded, respectively, to engage projections 10, extending outwardly from the cylinder-heads.

11 denotes packings within the caps to prevent the escape of steam. Upon the inner sides of the cylinder-heads are cams 12.

In order to make the construction and operation of the parts clear, I have denoted the apexes or highest portions of these cams by 12^a, and the lowest portions thereof by 12^b. Both inclines of these cams are alike, the curvature being convex near the apex and concave near the bottom. The opposite ends of the piston are provided with inclines 13, which are adapted to engage the cams. These inclines extend from a point denoted by 13^a, which projects beyond the end of the piston to a point denoted by 13^b, which is the bottom of a recess within the piston. (See Figs. 2 and 5.)

Turning now to Figs. 7, 8, and 9, the operation of the piston and piston-rod which moves with it will be clearly understood. It will be seen that the piston is just at the beginning of the movement toward the right.

For convenience in description, I will designate the short arm of grooves 7, by which steam is taken, as 7^a, and the long arm thereof, by which steam is exhausted, as 7^b.

It will be seen in Fig. 7 that the taking of steam from the steam-pipe by arm 7^b has commenced. As fast as the steam is taken by this groove, it passes through the left steam-

passages 8 into the left end of the cylinder and drives the piston toward the right. The highest portion 13^a of the right incline 13 an instant later comes in contact with the highest portion (denoted by 12^a) of the right cam 12, portion 13^a of the left incline being about to engage the portion of the left cam. (Denoted by 12^b.) It will be obvious, therefore, that as the movement of the piston toward the right continues it will be rotated toward the front, this movement alone imparting, approximately, a quarter-turn to the piston.

Fig. 8 shows the position of the parts at the end of the movement toward the right, the portion denoted by 13^a of the right incline being at the beginning of the portion of the right cam. (Denoted by 12^b.) The next quarter-turn of the piston is made without longitudinal movement, the portion 13^a of the right incline passing from the position shown in Fig. 8 to that shown in Fig. 9, this rotary movement of the piston being by momentum alone.

The position of the parts shown in Fig. 9 is just the reverse of that shown in Fig. 7. The portion 13^a of the right incline is in engagement with the portion of the right cam, (denoted by 12^b,) and the portion 13^a of the left incline is about to engage the portion 12^a of the left cam. When the parts are in this position, it will be apparent that steam is being taken by the short arm of the opposite T-shaped groove. The steam now taken passes through the right exhaust-passages 8 into the right end of the cylinder and acts to drive the piston toward the left. When the movement of the piston toward the left commences, it is obvious that the steam at the left end of the cylinder must pass through the left steam-passages 8 into the arm 7^b of the groove 7 opposite to the one that is taking steam, and thence out through exhaust-pipe 4, the same operation, of course, taking place during the movement of the piston toward the right, as is clearly shown in Fig. 4, in which figure the parts are shown in the position they occupied just an instant before the arm 7^a of one groove has ceased to take steam, and while steam is exhausting from the right end of the cylinder into the long arm 7^b of the opposite groove and out through the exhaust-pipe.

In Fig. 3 the parts are shown in a position midway between the positions shown in Figs. 7 and 8. At this instant steam is neither taken nor exhausted. The piston is not moving longitudinally, but is rotated by momentum alone toward the front.

In Fig. 10 the position of the parts is shown at the end of the movement toward the left. From this position to that shown in Fig. 7 there is no horizontal movement of the piston, but the quarter-turn by momentum alone, already referred to, takes place.

It will be obvious that various changes in the details of construction may be made without affecting in the slightest the principle of the invention.

I have stated that a quarter-turn of the piston takes place by momentum alone at each end of the stroke, and the other quarter-turns take place during the movements toward the right and left, respectively. These fractional parts of the rotation of the cylinder are approximate only, and may vary considerably, depending upon the use to which the engine is applied. In my working-engine the portions of the revolution of the piston that take place by momentum alone are somewhat less than quarter-turns, and the portions of the revolution that take place during the longitudinal movements somewhat greater than quarter-turns.

In Fig. 6 I have illustrated a modification of the shape of grooves 7. In this form the two arms of said grooves (one groove only being shown) are of equal length, each groove being of the shape of a St. Andrew's cross. In practice I vary the length of both arms 7^a and 7^b within reasonable limits. It is of course not practicable to illustrate in the drawings every possible variation that can be made in the length of the arms of these slots. It will be apparent, however, when arms 7^a of the grooves do not cross arms 7^b that the entrance of steam into the cylinder will be cut off before the piston has completed its forward movement, the steam in the end of the cylinder back of the piston acting expansively to continue the forward movement of the piston. When groove 7^a is extended across groove 7^b, as shown in Fig. 6, the exhaust-openings do not have to be continued across to communicate with the upper end of arm 7^b, but only extend to arm 7^a. In taking steam, however, it is manifest that steam will be taken the whole length of groove 7^a. The principle involved, therefore, is that the length of groove 7^a determines the length of time that steam is taken. The length of groove 7^b is not varied to any great extent in practice, as it is necessary that the steam at the ends of the cylinders should be exhausted until approximately the time that steam is permitted to enter that end of the cylinder. The effect of cutting off the exhaust earlier will be to form a steam-cushion at the end of the cylinder. In practice I sometimes allow sufficient steam to remain in the cylinder-head to prevent the piston from striking a blow. It is obvious that during the instant of time that lapses after steam is cut off and before it is again taken the cylinder will move by expansion or momentum or by momentum alone, this period being the latter portion of the reciprocatory movement in each direction and the period of rotary movement that follows before the return movement commences. It will be apparent from what has been said that rotary movement of the piston and piston-rod is continuous and regular.

14 denotes a fly-wheel, which may also serve as a belt-pulley. The fly-wheel is provided with a central hub 15, which is locked to a shaft 16, passing through it by a set-screw, as

shown in the drawings, or in any suitable manner. This shaft is provided with a cross-slot 17 and with a longitudinal opening 18, which receives the piston-rod. The cross-slot is engaged by a double spline 19 upon the piston-rod, the slot being made sufficiently long to permit the spline to reciprocate without coming in contact with the ends thereof as the piston moves backward and forward. It will be apparent, therefore, that by means of the spline and groove the continuous rotary movement of the piston-rod will be transmitted to the fly-wheel. In practice a belt may be placed upon the fly-wheel; or an additional belt-pulley may be provided.

In Fig. 3 I have shown, in addition to the essential parts of the engine, a bracket 20 as bolted to the left cylinder-head and the piston-rod as extended through said bracket. This is in order to make the piston-rod operate a boiler feed-pump, which may or may not be connected directly to bracket 20.

21 denotes the usual oil-holes in the cylinder for lubricating the piston. In practice I ordinarily so locate these oil-holes relatively to the piston that no steam can escape. If preferred, however, they may be placed at any portion of the cylinder and provided with pet-cocks in the ordinary manner.

Having thus described my invention, I claim—

1. A steam-cylinder having at opposite ends cams 12 and steam and exhaust pipes, in combination with a piston-rod extending through the ends of the cylinder and a piston secured thereto and provided with inclines 13, adapted to engage the cams, and peripheral grooves each having an arm 7^a, by which steam is taken, and an arm 7^b, and exhaust-openings leading therefrom to the end of the piston, substantially as described and shown.

2. The combination, with a steam-cylinder having at opposite ends cams with portions 12^a and 12^b, substantially as described, and steam and exhaust passages, of a piston having peripheral grooves with arms 7^a, by which steam is taken, and arms 7^b, and exhaust-openings 8, connected therewith, by which steam is exhausted, and at opposite ends thereof inclines having portions 13^a and 13^b adapted to engage the cams, so that the entrance of steam into the cylinder will impart longitudinal reciprocating motion to the piston, and also a complete rotation thereof during each reciprocation.

3. The cylinder having steam and exhaust pipes and cams having portions 12^a and 12^b at opposite ends thereof, in combination with a piston having grooves with arms 7^a and 7^b on the periphery thereof, and steam-passages connected to one of said arms, whereby steam is taken and exhausted, inclines at opposite ends thereof, having portions 13^a and 13^b adapted to engage the cams, and a piston-rod extending through the end of the cylinder and provided with a spline 19, a shaft having a longitudinal opening to receive the piston-rod, and a cross-slot to receive the spline, and a balance-wheel secured to said shaft.

4. The combination, with a steam-cylinder having the usual steam and exhaust openings, and having cams 12 at opposite ends thereof, of a piston having peripheral grooves and passages leading therefrom to the end of the piston and inclines 13 at opposite ends, adapted to engage cams 12, whereby both rotary and longitudinal reciprocating motions are imparted to the piston in use.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES A. WHEELER.

Witnesses:
A. M. WOOSTER,
A. I. MUNSON.